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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/964,227	09/26/2001	Jerome Tsu-Rong Chu	42022/MJM/A717	1865

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EXAMINER

VOCKRODT, JEFF B

ART UNIT PAPER NUMBER

2822

DATE MAILED: 11/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/964,227

Applicant(s)

CHU ET AL.

Examiner

Jeff Vockrodt

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 September 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) 20-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10, 12, 13 and 15-19 is/are rejected.
- 7) ☒ Claim(s) 11 and 14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

This office action is in response to the election filed on September 25, 2002. Claims 1-26 are pending. Claims 20-26 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made without traverse in Paper No. 9. Action on the merits of claims 1-19 follows.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1-3, 15-16, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Pat. No. 5,904,575 ("Ishida").

Ishida teaches a method of selectively incorporating nitrogen to affect differential oxide growth within a programming junction of an EEPROM device. Ishida replaces the conventional multi-mask oxidation programming junctions (PRJ) 110b for EEPROM with a single oxidation step that forms two oxide thickness 174, 130b and 172, 103c (Figs. 1-3; Figs. 9 and 15).

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Claim 1 reads on Ishida as follows: providing a semiconductor substrate 102; introducing n-type impurities to form a programming junction 110b (Fig. 2); introducing nitrogen into a portion of the programming junction 110b (compare Figs. 9 and 15 with Figs. 1-3; the inhibited region 174 of Fig. 15 corresponds to region 130b of Fig. 1, which is where a masking step was required in conventional EEPROM processes as shown in Fig. 3); after introducing nitrogen into region 170, the substrate is annealed to form a thin oxide 174 and a thick oxide 172 in a single oxidation step (Fig. 9).

Claim 2. The programming junction of an EEPROM is a low capacitor electrode while the floating gate forms the upper electrode with a tunneling oxide in between. It is the tunneling oxide that Ishida is concerned with.

Claims 3 and 19. Ishida uses GILD to introduce nitrogen in the preferred embodiment but clearly teaches that implantation could be used to place nitrogen selectively within the junction. Ishida, col. 6, ll. 12-27. Claim 19, the top capacitor plate or floating gate 106b of the EEPROM of Fig. 1 must be a conductor otherwise it will not work.

Claim 15. The region under thick oxide 172 has no nitrogen, while the region under thin oxide 174 has nitrogen.

Claim 16. The substrate 102 is silicon and its oxide 172, 174 is silicon oxide.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 5, 7, 9, 13, 15-16, and 18-19 rejected under 35 U.S.C. 103(a) as being unpatentable over Ishida in view of U.S. Pat. No. 5,854,114 ("Li").

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Ishida teaches a method of selectively incorporating nitrogen to affect differential oxide growth within a programming junction of an EEPROM device as discussed above. Ishida does not teach the claimed implant dose corresponding to the PRJ implant.

Li teaches a EEPROM cell similar to the EEPROM cell of Ishida's Figs. 1-3. Li teaches the EEPROM cell in more detail. Claims 7 and 13. Li teaches a PRJ implant of phosphorous with a dose of about 1×10^{14} to 1×10^{16} ions/cm² and an energy of 50-100 KeV. (Li, paragraph bridging cols. 4-5.)

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a dose of about 1×10^{14} to 1×10^{16} ions/cm² and an energy of 50-100 KeV to form the PRJ region of Ishida because these values are known for producing PRJ regions as taught by Li.

Claims 9 and 18 are met by the tunneling oxides grown simultaneously with the thin tunneling oxide 154 in (relatively) undoped portions of the substrate (Figs. 3l-3m).

Claims 1-3, 5, 6, 12, 17, 15-16, and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Ishida in view of U.S. Pat. No. 5,750,428 ("Chang").

Ishida teaches a method of selectively incorporating nitrogen to affect differential oxide growth within a programming junction of an EEPROM device as discussed above. Ishida teaches that the thin oxide is approximately 80-100 Angstroms while the thick oxide is approximately 140-180 angstroms. Ishida, col. 8, ll. 42-55. These ranges overlap the range wherein the thin oxide is less than 50% the thickness of the thick oxide. This substantial overlap between the claims and the prior art renders the claims prima facie obvious, particularly since there are no unexpected results for the oxide thickness. Additionally, with respect to claims 5, 6, 17, Chang teaches a non-volatile gate with a differentially grown oxide layer wherein the tunnel oxide is 50-100 angstroms and the gate oxide is 150-350 angstroms.

It would have been obvious to one of ordinary skill in the art at the time of the invention to form a tunnel oxide having a thickness of less than 55 angstroms and a gate oxide of 150 angstroms in the process of Ishida because these thickness were well known for EEPROM tunneling and gate oxides as taught by Chang.

Claim 12 requires oxidizing with a temperature range of 750°C-950°C (Ishida teaches 900°C, col. 8, ll. 42-48) for a time ranging from 5 to 15 minutes (Ishida does not disclose the time). Since these parameters together determine an oxide thickness that is met by Ishida the temperature is obvious in view of Ishida. 7

Claims 1-4, 8, 10, 15-16, and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Ishida in view of U.S. Pat. No. 5,942,780 ("Barsan").

Ishida teaches a method of selectively incorporating nitrogen to affect differential oxide growth within a programming junction of an EEPROM device as discussed above. Ishida teaches that nitrogen implantation was known but does not disclose a mask for use with nitrogen implantation and does not teach the claimed implantation parameters for the nitrogen implant.

Claims 4 and 8. Barsan teaches a nitrogen implant dose of $15 \times 10^{14}/\text{cm}^2$ at a range of 29-32 KeV effective to suppress oxide growth. (Barsan, paragraph bridging cols. 7-8). The difference between claim 4 is that the implant dose for nitrogen is claimed as 5-9 KeV while Barsan additionally teaches optimizing the implant to minimize implant induced damage. It would have been obvious to one of ordinary skill in the art at the time of the invention to lower the implant energy of Barsan to within 5-9 KeV so as to minimize implant damage as taught by Barsan.

Claim 10. Barsan teaches using a photoresist to mask a nitrogen implant for the purpose of suppressing oxide growth in an EEPROM device. It would have been obvious to

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one of ordinary skill in the art at the time of the invention to use a photoresist as an implant mask for nitrogen in the process of Ishida because Barsan teaches that photoresist were well known for masking nitrogen implants.

Allowable Subject Matter

Claims 11 and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 11 requires masking a nitrogen implant region having a rectangular shape and including sides ranging from 2 to 100 microns in length. In contrast, the tunnel oxide windows (where nitrogen is implanted) in the prior art of record have sides with lengths on the order of 0.5 x 1.3 microns as taught by U.S. Pat. No. 6,093,946 to Lee et al discussed below.

Claim 14 requires introducing nitrogen into at least one entire N-doped region of said N-doped regions which is in addition to the specific addition of nitrogen of the N-doped region of claim 1 that brings about the first and second oxide thickness within the N-doped region. The prior art of record directed to EEPROMs and tunneling oxides does not teach these limitations.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Pat. No. 6,093,946 to Lee et al discloses a tunnel window area that is 0.5 x 1.3 micron (col. 4, ll. 54-57).

Any inquiry concerning communications from the examiner should be directed to Jeff Vockrodt at (703) 306-9144 who can be reached on weekdays from 9:30 am to 5:00 pm EST. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian, can be reached at (703) 308-4905.

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The fax numbers for this Group are (703) 305-3432, (703) 308-7722, (703) 305-3431, and (703) 308-7724. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist at (703) 308-0956.

October 29, 2002

J. Vockrodt



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